

CLAIMS

1 1. An apparatus, comprising:
2 an expandable member being sized to be positionable in a sphincter; and
3 an energy delivery device coupled to the expandable member, the energy
4 delivery device having a configuration that controllably produces lesions of a
5 sufficient size, number and configuration in an interior of the sphincter so as to create
6 a selectable tightening of the sphincter.

1 2. The apparatus of claim 1, wherein the configuration of the energy
2 delivery device includes a plurality of energy delivery members distributed on a
3 surface of the expandable member.

1 3. The apparatus of claim 2, wherein the plurality of energy delivery
2 members are radially distributed along a surface of the energy delivery device
3 expandable member.

1 4. The apparatus of claim 2, wherein the plurality of energy delivery
2 members are longitudinally distributed along a surface of the expandable member.

1 5. The apparatus of claim 1, wherein the energy delivery device covers
2 a portion of the surface of the expandable member.

1 6. The apparatus of claim 2, wherein the energy delivery device covers
2 substantially all of an exterior surface of the expandable member

1 7. The apparatus of claim 1, wherein the expandable member is sized
2 to be positionable in a sphincter and to allow the energy delivery device to contact a
3 portion of the inner surface of a sphincter.

1 8. The apparatus of claim 1, wherein the expandable member is sized
2 to be positionable in a sphincter and to allow the energy delivery device to contact all
3 of an inner surface of the sphincter.

1 9. The apparatus of claim 1, where the energy delivery device is sized to
2 be positionable in the sphincter and non-permanently dilate the sphincter from a
3 contracted state; and
4 wherein the sphincter returns to a pretreatment contracted state upon a
5 removal of the expandable member from the sphincter.

1 10. The apparatus of claim 1, wherein the lesions are formed in a muscle
2 tissue underlying a sphincter mucosal layer.

1 11. The apparatus of claim 1, wherein the sphincter is a lower
2 esophageal sphincter.

1 12. The apparatus of claim 1, wherein the configuration of the energy
2 delivery device creates the lesions at a fixed depth from a mucosal surface layer of the
3 sphincter of no more than 4 mms.

1 13. The apparatus of claim 1, wherein the configuration of the energy
2 delivery device creates the lesions and minimizes injury to a mucosal and a
3 submucosal layer of the sphincter.

1 14. The apparatus of claim 1, wherein the configuration of the energy
2 delivery device creates the lesions and reduces a frequency of sphincter relaxation.

1 15. The apparatus of claim 1, wherein the configuration of the energy
2 delivery device creates the lesions and reduces a duration of sphincter relaxation.

1 16. The apparatus of claim 1, wherein the configuration of the energy
2 delivery device creates the lesions and reduces a frequency of reflux of stomach
3 contents into an esophagus.

1 17. The apparatus of claim 1, wherein the configuration of the energy
2 delivery device creates the lesions and reduces a frequency of a symptom of reflux of
3 stomach contents into an esophagus.

1 18. The apparatus of claim 1, wherein the configuration of the energy
2 delivery device creates the lesions and reduces an incidence of a sequela of reflux of
3 stomach contents into an esophagus.

1 19. The apparatus of claim 1, wherein the energy delivery device is
2 positioned on an exterior surface of the expandable member.

1 20. The apparatus of claim 1, wherein the energy delivery device is
2 positioned on an interior surface of the expandable member.

1 21. The apparatus of claim 1, further comprising:
2 a lumen positioned in an interior of the expandable member.

1 22. The apparatus of claim 1, wherein the expandable member is
2 expandable.

1 23. The apparatus of claim 1, wherein the expandable member is a
2 balloon.

1 24. The apparatus of claim 1, wherein the expandable member is made
2 of an expandable material.

1 25. The apparatus of claim 1, wherein the expandable member is made
2 of a porous material.

1 26. The apparatus of claim 1, further comprising:
2 an electrolytic solution housed in an expanded expandable member.

1 27. The apparatus of claim 1, wherein the configuration of the energy
2 delivery device delivers energy to promote a fibroblast cell infiltration at a site of the
3 lesions.

1 28. The apparatus of claim 1, wherein the configuration of the energy
2 delivery device delivers energy to promote a fibroblast growth at a site of the lesions.

1 29. The apparatus of claim 1, wherein the configuration of the energy
2 delivery device delivers energy that promotes a myofibroblast cell infiltration at a site
3 of the lesions.

1 30. The apparatus of claim 1, wherein the configuration of the energy
2 delivery device creates a tightening of a lower esophageal sphincter without
3 permanently damaging anatomical structures near the lower esophageal sphincter.

1 31. The apparatus of claim 1, wherein the configuration of the energy
2 delivery device creates a tightening of the lower esophageal sphincter without
3 permanently damaging an aorta positioned near the lower esophageal sphincter.

1 32. The apparatus of claim 1, wherein the configuration of the energy
2 delivery device creates a tightening of the lower esophageal sphincter without
3 permanently damaging a vagus nerve positioned near the lower esophageal sphincter.

1 33. The apparatus of claim 1, wherein the configuration of the energy
2 delivery device creates a tightening of the lower esophageal sphincter without
3 permanently damaging an esophageal plexus of nerves and veins positioned near the
4 lower esophageal sphincter.

1 34. The apparatus of claim 1, wherein the configuration of the energy
2 delivery device creates a tightening of the lower esophageal sphincter while preserving
3 a blood supply to the lower esophageal sphincter.

1 35. The apparatus of claim 1, wherein the energy delivery device is an
2 RF electrode.

1 36. The apparatus of claim 35, further comprising:
2 an RF energy source coupled to the RF electrode.

1 37. The apparatus of claim 1, wherein the energy delivery device is a
2 microwave antenna.

1 38. The apparatus of claim 37, further comprising:
2 a microwave energy source coupled to the microwave antenna.

1 39. The apparatus of claim 1, wherein the energy delivery device is a
2 waveguide.

40. The apparatus of claim 39, further comprising:
a light source coupled to the waveguide.

41. The apparatus of claim 40, wherein the light source is a laser.

42. The apparatus of claim 1, wherein the energy delivery device is an acoustical transducer.

43. The apparatus of claim 1, wherein the energy delivery device is a resistive heating device.

44. The apparatus of claim 1, further comprising:
a visualization device coupled to the expandable member.

45. The apparatus of claim 1, further comprising:
an extension member coupled to the expandable member.

46. The apparatus of claim 45, wherein a proximal portion of the extension member is maneuverable by a medical practitioner.

47. The apparatus of claim 1, wherein the energy delivery device is a plurality of RF electrodes.

48. The apparatus of claim 47, wherein the plurality of electrodes is a flexible circuit.

49. The apparatus of claim 1, further comprising:
a mechanical expansion device coupled to the expandable member.

1 64. The apparatus of claim 50, wherein the configuration of the energy
2 delivery device means creates a tightening of the lower esophageal sphincter without
3 permanently damaging an esophageal plexus of nerves and veins positioned near the
4 lower esophageal sphincter.

1 65. The apparatus of claim 50, wherein the configuration of the energy
2 delivery device means creates a tightening of the lower esophageal sphincter while
3 preserving a blood supply to the lower esophageal sphincter.

1 66. The apparatus of claim 50, wherein the configuration of the energy
2 delivery device means creates a tightening of the lower esophageal sphincter while
3 creating submucosal lesions in the lower esophageal sphincter.

1 67. The apparatus of claim 50, wherein the energy delivery device means
2 is an RF electrode means.

1 68. The apparatus of claim 47, further comprising:
2 an RF energy source means coupled to the RF electrode means.

1 69. The apparatus of claim 50, wherein the energy delivery device means
2 is a microwave antenna means.

1 70. The apparatus of claim 69, further comprising:
2 a microwave energy source means coupled to the microwave antenna means.

1 71. The apparatus of claim 50, wherein the energy delivery device means
2 is a waveguide means.

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1 72. The apparatus of claim 71, further comprising:
2 a light source means coupled to the waveguide means.

1 73. The apparatus of claim 72, wherein the light source means is a laser
2 means.

1 74. The apparatus of claim 50, wherein the energy delivery device means
2 is an acoustical transducer means.

1 75. The apparatus of claim 74, further comprising:
2 an acoustical energy source means coupled to the acoustical transducer
3 means.

1 76. The apparatus of claim 50, wherein the energy delivery device means
2 is a resistive heating device means.

1 77. The apparatus of claim 50, further comprising:
2 a visualization device means coupled to the expandable member means.

1 78. The apparatus of claim 50, further comprising:
2 a extension member means coupled to the expandable member means.

1 79. The apparatus of claim 78, wherein a proximal portion of the
2 extension member means is maneuverable by a medical practioner.

1 80. The apparatus of claim 50, wherein the energy delivery device means
2 is a plurality of RF electrode means.

1 81. The apparatus of claim 80, wherein the plurality of electrode means
2 is a flexible circuit means.

1 82. The apparatus of claim 50, further comprising:
2 a mechanical expansion device means coupled to the expandable member
3 means.

1 83. A method of treating a sphincter, comprising:
2 providing an expandable member sized to be positionable in the sphincter and
3 configured to non-permanently open the sphincter from a contracted configuration,
4 and an energy delivery device coupled to the expandable member;
5 introducing the expandable member in the sphincter;
6 dilating the sphincter from the contracted state;
7 delivering sufficient energy from the energy source to the sphincter to tighten
8 the sphincter; and
9 removing the expandable member from the sphincter.

1 84. The method of claim 83, wherein the energy delivery device has a
2 configuration that controllably produces lesions an interior of the sphincter without
3 creating a permanent impairment of the sphincter's ability to achieve a physiologically
4 normal state of closure.

1 85. The method of claim 83, wherein energy delivery device delivers
2 sufficient energy to cause a proliferation of fibroblast cells in the sphincter.

1 86. The method of claim 85, wherein the energy delivery device delivers
2 sufficient energy to cause a proliferation of myofibroblast cells in the sphincter.

1 87. The method of claim 83, wherein the energy delivery device delivers
2 sufficient energy to create a tightening of the sphincter without permanently damaging
3 anatomical structures near the sphincter.

1 88. The method of claim 87, wherein the energy delivery device delivers
2 sufficient energy to create a tightening of the sphincter without permanently
3 disrupting an aorta positioned near the sphincter.

1 89. The method of claim 87, wherein the energy delivery device delivers
2 a sufficient amount of energy to create a tightening of the lower esophageal sphincter
3 without permanently damaging a vagus nerve positioned near the sphincter.

1 90. The method of claim 87, wherein the energy delivery device delivers
2 a sufficient amount of energy to create a tightening of the lower esophageal sphincter
3 without permanently damaging an esophageal plexus of nerves and veins positioned
4 near the sphincter.

1 91. The method of claim 87, wherein the energy delivery device delivers
2 a sufficient amount of energy to create a tightening of the lower esophageal sphincter
3 while preserving a blood supply to the sphincter.

1 92. The method of claim 83, wherein the energy delivery device creates
2 a tightening of the lower esophageal sphincter while creating submucosal lesions in
3 the sphincter.

1 93. The method of claim 83, wherein the expandable member is
2 expandable.

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1 94. The method of claim 73, wherein the expandable member is
2 introduced in the lower esophageal sphincter in an unexpanded state.

1 95. The method of claim 94, wherein the expandable member is
2 expanded to an expanded state when positioned in the sphincter.

1 96. The method of claim 93, wherein the expandable member is a
2 balloon.

1 97. The method of claim 93, further comprising:
2 an electrolytic solution housed in an expanded expandable member.

1 98. The method of claim 83, wherein the energy delivery device is an RF
2 electrode.

1 99. The method of claim 98, further comprising:
2 an RF energy source coupled to the RF electrode.

1 100. The method of claim 83, wherein the energy delivery device is a
2 microwave antenna.

1 101. The method of claim 100, further comprising:
2 a microwave energy source coupled to the microwave antenna.

1 102. The method of claim 83, wherein the energy delivery device is a
2 waveguide.

1 103. The method of claim 102, further comprising:

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2 a light source coupled to the waveguide.

1 104. The method of claim 83, wherein the light source is a laser.

1 105. The method of claim 83, wherein the energy delivery device is an
2 acoustical transducer.

1 106. The method of claim 105, further comprising:
2 an acoustical energy source coupled to the acoustical transducer.

1 107. The method of claim 83, wherein the energy delivery device is a
2 resistive heating device.

1 108. The method of claim 83, wherein the energy delivery device is
2 delivered to the sphincter transorally without an endoscope.

1 109. The method of claim 83, wherein the energy delivery device is
2 delivered to the sphincter with an endoscope.

1 110. The method of claim 83, wherein the sphincter is the lower
2 esophageal sphincter.